

TITLE

**Closed Suctioning System of Endotracheal Tube (CTSS):
The Practice and Perception of Intensive Care Nurses**

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Critical Care and Trauma Nursing

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DEDICATION

I dedicate this dissertation to my wife Muntaha and our two sons Haythem and Hani who have been always supportive, patient, and understanding.

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A.M. Ali

DECLARATION

Except for referenced citations in text, this is the
researcher's original work

Signature ----- Date: January 8, 2002

ABSTRACT

Closed Suctioning System of Endotracheal Tube (CTSS): The Practice and Perception of Intensive Care Nurses

Purpose: The of this study was to explore the knowledge, level of practice, and the frequency of problems met during the use of CTSS amongst intensive care unit (ICU) nurses and suggest ways to improve the use of the system. **Design:** A non experimental exploratory design using a descriptive survey approach was employed. **Sample:** The sample of participants were taken from three governmental hospitals in Abu Dhabi chosen randomly. It included all nurses in the ICUs of three hospitals who happened to be working at the time of the study. The response was **Eighty three staff nurses**, three charge nurses, and one respiratory therapist. **Instrument:** A questionnaire consisting of twenty one questions was used to explore the ICU nurses' knowledge, experience, practice, and difficulties met by nurses. Averages, tables, figures, and correlation coefficient were used to analyze the data. **Results:** Results showed a positive correlation (+0.0433) between the level of knowledge and length of use of the system but the effect is minimal. Again the knowledge and the frequency of use on ventilated patients were minimally positive (+0.0898). On the other hand, the relation between

the frequency of use and the years of experience was more positively related than the frequency of use and the knowledge.

Conclusion: There is a need to set a plan aiming at making the system more frequently used. Not only that, but it should be used safely and appropriately and supported by policy and procedure guidelines. Key words: ICU experience, CTSS training and experience, Difficulties, Knowledge, Current level of use, Efficiency, ICU nurses, Respiratory Therapist, Charge Nurse, and Head Nurse.

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CHAPTER ONE: INTRODUCTION

Problem statement

Suctioning by using the closed tracheal suctioning system (CTSS) has physiological benefits for the critically ill patients (Blackwood, 1998). In CTSS, the introduction of contaminants in the trachea is avoided, positive end expiratory pressure (PEEP) is maintained, it is cost saving, and protect the nurse from exposure to secretions (Galvin & Cusano, 1998).

Despite these benefits, nurses have raised concerns about CTSS, such as condensate from the flush port which splashes over the hands when nurses irrigate the suction catheter through the irrigation port, difficulty cleansing the tube after use, ineffective secretion removal and sticking of the CTSS tube in the ETT (endotracheal tube) (Blackwood, 1998). Unavailability of the system is another concern raised by intensive care unit (ICU) nurses in Abu Dhabi hospitals.

From my personal observations and interviews with some of the ICU nurses, the practice of CTSS is still limited in the ICUs of Abu Dhabi hospitals. The question is therefore what are the perceptions of ICU nurses in the UAE with regard to the use of CTSS?

Background

For evidence-based practice to become a reality, nurses need to demonstrate its effect in the clinical situation. Sullivan (1998) and Thompson (1998) pointed out evidence-based practice integrates research evidence with clinical expertise, the resources available, and the views of patients. This was supported by Cullum (1998) who emphasized the relationship between the practice and the access of nurses to high quality evidence based information.

Nolan, Morgan, & Curran (1998) pointed out that formidable obstacles to integration of research to practice are still present. More studies supported this finding. Hunt (1996) and Thompson (1998) addressed the issue of barriers to applying theory to practice on the basis of evidence and research. They listed a number of obstacles. These barriers are: poor access of nurses to research resources, some do not believe in research findings, others are unable to understand and interpret these findings, and in some instances they are not allowed to use these findings.

To have a quality of care, nursing needs to change from intuitions and routines to have practice guidelines based on evidence and research findings. Change as stated by Belasco (1990) & Montgomery (1994) is a process that never ends. It is

not a destination. Change depends more on the process than the end goal.

To bring up a change in clinical practice, nurses need to adopt a strategy (Ohmer 1992). Montgomery (1994) cited a number of strategies used in the process of change. She added that the strategy, which involves a clear understanding of the elements of the situation, restructuring the elements in the most advantageous way, and finding the best possible solution for the problem at hand, is the normative reeducation model. This model is best known by Lewin (1951). It focuses on the total system including the potential players of the stakeholders. Montgomery added that the model identifies three phases. These are unfreezing, moving to a change, and the third is the freezing phase. Moreover this model considers that the two forces act in change; the driving and the restraining ones. This force field map is developed in the first phase. In the second phase, the staff are directed to produce the change through discussion of their feelings, by providing them with necessary information, and supporting and anticipating the normal differences in their adoption to change.

Purpose of the study:

The purpose of this study is to identify the various problems met during closed suctioning system, the experience of nurses in practicing this technique, and to find ways to orient

and educate the ICU nurses on the benefits and practice of CTSS.

Objectives:

- ☐ Explore the current level of use of CTSS amongst ICU nurses.
- ☐ Explore the knowledge of ICU nurses regarding the advantages of CTSS over the open suctioning system.
- ☐ Explore the difficulties met by ICU nurses during CTSS suctioning
- ☐ Explore the influence of the years of experience on the use of CTSS.
- ☐ Explore the influence of training on the use of CTSS.

Research questions:

How do ICU nurses in Abu Dhabi hospitals perceive CTSS of trachobronchial tract in ventilated patients? More specifically:

1. How often do they use this procedure?
2. What do they see as the indications or contra-indications?
3. What are the barriers of use?
4. Which demographic factors influence levels of use?

Significance of the study:

This study could lead to improved education of nurses working in ICUs, thus increasing both their level of use of

CTSS, and their efficiency of use. This could show the impact of using CTSS on the care of the large number of ventilated patients each year and by reducing infections in patients as well as in nurses. This could then decrease the cost of supplies, which is a chronic problem in Abu Dhabi hospitals. Decreasing complications means reducing hospital stay, cutting on hospital expenses and shortage of beds.

Decreasing infection also decreases the suffering of patients, and this aspect is an important consideration. Decreased hospital stay also limits the disruption of the illness on the life of the patients.

Since shortage of nurses is also a chronic problem, the fact that CTSS could save the time of nurses by decreasing time demanded by suctioning is also an important consideration.

Definition of terms:

- ☐ ICU experience: Is the length of time the staff member has been working in ICU.
- ☐ CTSS: It is a system used to suction the trachea of ventilated patients without disconnecting these patient from ventilator
- ☐ CTSS experience: The length of time the staff member has been using the CTSS.

- CTSS Training: Attendance of a training session given by CTSS company representatives.
- Difficulties: Factors that are considered risky for nurses and patients as identified or described by nurses.
- Current level of use: The frequency that nurses use the CTSS to suction ventilated patients as a percentage of total frequency of suctioning.
- Knowledge: Knowledge of nurses on the conditions that necessitates the use of CTSS, and the benefits of this type of suctioning, based on a written test.
- ICU nurses: Nurses currently working in an ICU, with variety of experiences.
- Charge nurse: A nurse who assumes responsibility over a shift during the day.
- Head nurse: A Nurse who is totally responsible for a ward.
- Respiratory therapist: A nurse who has a course in respiratory therapy. She/he assumes the responsibility of giving respiratory care for ICU patients like tracheal suctioning. She/he also responsible for setting, preparing, connecting ventilators to patients and monitoring arterial blood gasses (ABGs) levels.

CHAPTER TWO: LITERATURE REVIEW

Introduction

The literature review for this research covers the benefits and disadvantages of closed tracheal suctioning system (CTSS) as compared to open suctioning method (OSM). The areas of concern are the effect on oxygen saturation, hemodynamic stability, infection, tracheal injury, the cost, and maintenance of positive end expiratory pressure (PEEP).

Closed Tracheal Suctioning System (CTSS) versus Open Suctioning method (OSM)

The OSM involves the use of a sterile disposable suction catheter. It necessitates the disconnection of the ventilator from the endotracheal catheter (Blackwood, 1998). In contrast, the CTSS is a catheter setup that is enclosed within a plastic sheath. The sheath allows for suctioning of the patient without exposing the catheter and requiring the removal of the patient from ventilator (Hyperlink http://www.rtccorner.com/examinations/exam%20Topic/Airway/closed_suction_ca18/11/21n; Weber, 1988; Baker, 1989).

Tracheal suctioning, CTSS or OSM, is performed on all patients with artificial airway whether it is endotracheal intubation or tracheostomy catheter. In both cases the cough reflex is depressed. Suctioning is done to clear the airway from secretions. It is needed to maintain an open airway and

prevent atelectasis (Bostic & Windelglass, 1987; Kuzenski, 1978 and Raymond, 1995).

Several researchers have studied the use of OSM. They found that although it is necessary to maintain an open airway, it has a lot of hazards. They found that tracheal erosion, bronchospasm, infection, hypoxemia, bradycardia, dysrhythmia, hypotension, and death are common hazards of OSM (Raymond, 1995; Wood, 1998) . By using CTSS, these complications can be avoided. Some disadvantages have been reported in CTSS like bacterial colonization, the effect on heart rate, tracheal damage and increase in negative pressure. All of these will be addressed in the following studies which are grouped according to the effect.

The effect on the trachea

Czarnik, Stone, & Everhart (1991) conducted a study on a sample of twelve dogs. They tested the effect of continuous versus intermittent suction on tracheal tissues. They found that in both OSM and the CTSS there was a significant damage to tracheal tissues.

Furthermore, Gugliclminotti, Desmonts, & Durenil (1998) studied the effects of tracheal suctioning on respiratory resistance in ventilated patients. The study was done on thirteen sedated critically ill patients. They found that

regardless of the method used, tracheal suctioning evoked a potent transient bronchoconstriction but did not produce airway resistance below the pre-suctioning level. This study is limited by the small sample.

Effect on heart rate and blood pressure

Studies have shown no significant difference in heart rate change between CTSS and OSM.

Mattar, Sproesser, & Gomes (1992) did a comparative study of oxygen transport during open and closed tracheal suctioning. The study was conducted on a prospective fashion on 22 mechanically ventilated patients (14 males and 8 females). Heart rate, cardiac index, stroke index, and arterial oxygen saturation were monitored continuously. They found that heart rate changed significantly in both procedures. This study was supported by Demajo (1989) who studied the effects of suctioning patients without interruption of ventilation. He investigated the effect of suctioning using CTSS versus the OSM on heart rate and blood pressure. The sample composed of seven patients suffering from respiratory failure of varied etiology. A total of 42 readings were recorded. He found that no difference in blood pressure, heart rate, or coughing was noted.

The effect on PEEP

Maintaining the positive end expiratory pressure (the air way pressure which is applied at the end of expiration phase to keep alveoli inflated and prevent it from collapse) is an important concept addressed by researchers. A number of studies tested the effect of CTSS in maintaining positive end expiratory pressure (PEEP) as compared to OSM. They found that CTSS is an effective way in maintaining the level of PEEP and thus preventing atelectasis (Noll, 1990; Ritz, Scott, & Coyle 1986). Billingsley & Radford (1989) supported the importance of CTSS in maintaining the PEEP. But they pointed out that on a level of PEEP less than 10 cm of water; there was no significant effect.

The effect on oxygen saturation (Sao₂)

It has been found that CSS prevents the decrease in oxygen saturation which is evident in OSM. Demajo (1989) studied the effects of suctioning patients without interruption of ventilation. He investigated the effect of suctioning using CSS versus the OSM on heart rate and blood pressure. The sample composed of seven patients suffering from respiratory failure of varied etiology. A total of 42 readings were recorded. There was a significant difference in oxygen desaturation with the fall being significantly less in CTSS. This was supported by another study was done by Wilhem, Doran, and Adams (1989). They studied the effect of CTSS versus OSM on suction induced

arterial desaturation. The study done on twelve patients with chronic respiratory conditions requiring tracheostomy and asignificant ($p < 0.001$) reduction in oxygen desaturation was attained when compared to OSM. Furthermore Brown, Stansbury, & Merrill (1983) studied the suction related arterial desaturation in CTSS versus OSM. The study was done on 22 ventilated patients. They found that oxygen desaturation is minimized by using CTSS.

The use of hyperventilation and hyperoxygenation in CTSS versus OSM

Another area of concern was to explore studies done on the use of hyperoxygenation and hyperinflation with open suctioning method; studies that compared manual and ventilator methods to achieve hyperoxygenation and hyper-inflation with the open suctioning method; studies that compared open suctioning method with closed-system suctioning, and studies that strictly involved the use of closed-system suctioning.

Stone, Vorst, Lanham, & Zahn (1989); Chulay (1988) & Goodnough (1985) investigated the effects of both hyperoxygenation and hyperinflation on the occurrence of suctioning-induced hypoxemia associated with open-system suctioning. The results of these three studies supported the use of both hyperoxygenation and hyperinflation during open-system suctioning to prevent suctioning-induced hypoxemia.

Few studies have tested the effects of hyperoxygenation and hyperinflation, together or separately, on the prevention of suctioning-induced hypoxemia with only closed-system suctioning. Craig, Benson, & Pierson (1984) used repeated measures within-subjects design to compare oxygen saturation values before and after closed-system suctioning in 17 intubated adult patients. When patients had pre-oxygenation, the greatest decrease in arterial oxygen saturation (Sao2) was 2%. Without pre-oxygenation, Sao2 decreased 3% or less in most patients. Since the decrease in the percentage of oxygen saturation is minimal, this study supports the concept that the use of CTSS eliminates the need for pre-oxygenation.

Similarly, Harshbarger, Hoffman, Zullo, & Pinsky (1992) studied hyperoxygenation with a closed-system in a sample of 18 patients. Fourteen of the 18 did not experience a change in Sao2 when suctioning was not preceded by hyperoxygenation, whereas four subjects experienced a profound decrease in Sao2 (in one subject, Sao2 decreased 9%) when hyperoxygenation was not established beforehand. The authors recommended the use of hyperoxygenation before and after tracheobronchial suctioning in order to prevent desaturation.

In another study, critical care nurses were surveyed about their perceptions of the closed tracheal suctioning system and hemodynamic stability, preoxygenation requirements, removal of

lung secretions, and safety issues concerning patients and staff members. Ninety-two percent of the respondents noted no desaturation or hemodynamic instability with the closed tracheal suctioning system. Hyperoxygenation with a fraction of inspired oxygen of 0.1% was used only when nurses noted hemodynamic instability during the first attempt of closed-system suctioning (Crimlisk, Paris, McGonagle, Calcutt, & Farber, 1994).

Hyperinflation practices of nurses using closed-system suctioning were not assessed. The ventilator is often used to establish hyperinflation during open-system suctioning.

However, Paul-Allen, & Ostrow (2000) found no reports of research that examined the effects of the use of hyperinflation alone, or in addition to hyperoxygenation, during closed-system suctioning.

The effect on bacterial colonization and infection

Infection is one of the major risks in OSM. The Occupational Safety and Health Administration (OSHA) standards on staff exposure to Hepatitis B virus, human immunodeficiency virus, and blood borne pathogens (1991) recommended in its guidelines to perform all procedures involving potentially infectious material in such a manner to minimize splashing and generation of secretions.

However, one study addressed the colonization issue in both CTSS and OSM. In this study, Deppe, Kelly, & Thoi (1990) found that colonization was higher in CSS. They added that colonization was not a significant factor in mortality and thus CTSS does not increase the mortality and morbidity due to nosocomial pneumonia.

Furthermore, studies strongly supported the findings that CSS when compared with OSM is effective in preventing ventilator-associated pneumonia, but disagreed with the study of Deppe et al. (1990) about bacterial colonization of the endotracheal tube. They found that there was less colonization of the endotracheal tube in CTSS (Hyperlink http://www.rtc corner.com/examinations/exam%20Topic/Airway/closed_suction_ca18/11/21n; Weber, 1988; Baker, 1989).

Effect on the cost

Johnson, Kearney, & Johnson (1994) studied the cost and physiologic consequences of CTSS versus OSM. Using a prospective randomized controlled approach, they selected a sample of 35 patients. They found that the closed method is effective and cost efficient as compared by OSM. The cost of OSM was \$1.88 more per patient per day and required more nursing time.

This was supported by another study done by DePew, Mosely, & Clark (1994). They compared the cost of CTSS versus OSM. This was evaluated on the basis of the frequency of suctioning per patient in a 24 hour period. They found that CTSS costs nine times more if the suctioning is limited to nine times per day. Further examination revealed that the total monthly cost was not only influenced by the cost of the item but also by the frequency per patient.

Kollef, Prentice, & Steven (1997) addressed another aspect of the problem in order to maximize the cost effectiveness. They studied the effect of the routine change of in-line catheter on the cost of tracheal suctioning. The study was done on a randomized sample composed of 258 patients who received non routine change of catheter and 263 patients who their catheters were changed every 24 hours. They found that elimination of the routine change of in-line catheter is safe and can reduce the cost.

Findings about the practice and perception of nurses

Paul-Allen & Ostrow (2000) surveyed the nursing practice with CTSS. The survey was done on 241 critical care nurses who are members in the American Association of Critical Care Nurses in the mid atlantic region of the USA. They found that CTSS is a common practice but the nursing practice varies from one nurse to another. Moreover, they found that there is a

knowledge deficit about the proper practice of hyperinflation and hyperoxygenation. Another study was done by Brookes, Solway, & Graham (1999) reached to a similar results concerning the discrepancies in practice, in this study the survey included a random sample of 448 nurses, physiotherapists and respiratory therapists.

Theoretical framework for the study

Closed endotracheal suctioning system is a procedure that needs to be done based on well identified indications and practiced according to a set of guidelines.

The procedure entails closed system to facilitate continuous mechanical ventilation and oxygenation during suctioning.

A set of guidelines should be followed to maintain a safe procedure and maintain a desirable outcome. The main guidelines are: Assessing the need for suctioning, maintain a sterile technique all through the procedure, use universal precaution, hyperoxygenate and hyperventilate before and after the procedure in conjunction with the respiratory and cardiovascular parameters of the patient, maintain closed system during the procedure, limit the each suctioning to 10 to 15 seconds only

anticipate complications and stop the procedure if it happens, change the catheter on daily basis (AARC Clinical Practice Quidelines, 1996)

The nurse needs to assess for the presence of the following indications: coarse breath sounds, increased peak inspiratory pressure during pressure controlled ventilation, inability to generate a spontaneous effective cough, visible secretions in the airway, changes in ventilatory and hemodynamic parameters, deterioration of arterial blood gases, and retention of pulmonary secretions as evdident by chest x-ray (AARC Clinical Practice Quidelines, 1996). If these are present, CTSS is the procedure of choice according to current research evidence.

CHAPTER THREE: METHODOLOGY

Design

A non-experimental exploratory survey, descriptive approach was used. This design was utilized to gain more information and identify problems with the current practice of CTSS. It gives a better picture of this phenomenon. There is no dependent and independent variables in this study. The variables here are identified to obtain an overall picture of the situation and examine the degree and type of relationship. This makes the non-experimental survey design was appropriate for this study.

Sample and sampling procedure:

The three hospitals were chosen randomly from a group of hospitals in the Abu Dhabi emirate at the time of the study. The sample included all nurses and one respiratory therapist. A total of 100 subjects who are working full time in the ICU'S of the three hospitals. These nurses are multinational with a broad variety of experience. The responses were 87% of the total sample.

Research setting:

There are three intensive care units (ICUs) in the city of Abu Dhabi which are fully equipped, serving a population of 1.5 millions. Some have very advanced monitoring and ventilatory equipment. Most of the nurses ICU staff by experience only,

with no special ICU certification. A large number had orientation to the use of CTSS. In spite of that, CTSS is rarely used.

The total capacity of the three ICUs is 40 patients. The quality of patients is a mix of medical, surgical, and trauma. The ratio of patient nurse is two to one. A respiratory therapist is available all the time on morning shifts.

In these units, not all ventilated patients are put on a closed tracheal suctioning system.

Data collection instrument

The questionnaire was developed to cover all the information required for the research. The questionnaire as adapted from a similar questionnaire used by previous researchers, Paul-Allen and Ostrow (2000) and Blackwood (1998). Considering the number of the sample in the study (100 subjects), the questions were structured in a closed ended fashion with options selected. The questionnaire consisted of 21 questions. Clear instructions of how to mark the answers were given to avoid ambiguity. Value connotation questions and leading questions were avoided.

The reason for using a questionnaire was more specific and it is an objective data collection instrument to obtain the

information needed for this study. The instrument used the following types of items:

1. Multiple choice (All items except these listed below)
2. Rating scale (Items 10, 12 to 16, 18, and 21)
3. Screening items (Item 11b)
4. Open ended (Item 8b)

This combination of types makes it possible to give respondents adequate choice, while still making analysis easy.

The questionnaire was designed to determine facts about the practice, training, experience and the knowledge of nurses with CTSS, it also covers the difficulties met during the use of CTSS. It includes the following demographic data about the subjects: sex, age, nationality, and job title. In the section of experience and training, the questions cover the length of employment in intensive care nursing, the length of time dealing with CTSS, and any training on the use of CTSS received by the subject and the type of training received. The data collection instrument covers the frequency of use and the availability of policy and procedure guidelines for the practice of CTSS. It measures the knowledge of subjects on the frequency of using hyperventilation and hyperoxygenation and the time it is done related to the suction procedure. The instrument addresses the difficulties that the subjects meet during the application of the procedure.

The questionnaire was piloted in the three intensive care units selected. This was done by selecting a random sample of five nurses. These nurses are not included in the major study. The questionnaire was returned with all questions answered. Two subjects left the description of the training empty.

The content of the instrument is summarized in Table One.

TABLE ONE: CONTENT VAILIDTY OF INSTRUMENT

Area covered	Item numbers	Number of items
Demographics	1 to 4	4
Experience and training	5 to 8	4
Frequency of use	9 to 10	2
Difficulties	11 to 13	3
Knowledge	14 to 21	8

Data collection procedure:

The questionnaire was prepared with a cover page explaining the purpose of the study, guidelines of how to fill in the questionnaire and addressing the confidentiality of the information (see appendix 1). The questionnaire was distributed by the researcher to the three ICU units. With the permission of the head nurses, the forms were left in her office for distribution. Nurses were asked to return their completed questionnaire to the head nurses. Some of the completed forms were collected directly from the subjects if they happened to be available at the time when the researcher was collecting the

forms. After one week of distributing the questionnaire, the researcher went around the three hospitals and collected the completed forms from the head nurses. This was done weekly for three weeks giving time to those who were off duty the opportunity to return the completed forms. One difficulty was the inability to get those who were on annual leave to participate.

Validity and reliability:

To ensure content validity, expert validity was checked by sending The questionnaire to the directors and the supervisors of the critical care units of the three hospitals who are experts on the subject. The questions were checked for relevancy to the study, degree of coverage of the concept and feasibility related to the level of the subjects involved. Moreover, face validity was checked by giving the questionnaire to the directors of nursing in the three hospitals to read. The reviewers agreed that the proposed questionnaire looked valid.

Internal validity is a concept that you can only address by doing some statistical calculations.

Since this is a replication of a study that has been done before, generalizing it becomes possible.

All subjects in the chosen units had an equal chance in contributing to the study. The selection was not done on the bases of any differences between the subjects. To address reliability, the data was collected from the primary sources who were dealing with the concept of the study directly.

Ethical consideration

A cover page was attached explaining the purpose of the study and included guidelines on how to answer the questionnaire.

The participants were assured that all information given would be treated with confidentiality. They were informed that returning the questionnaire would be considered an agreement from them to participate, otherwise the participant can chose not to return the questionnaire. To ensure equal and fair selection of participants, all nurses working in ICU regardless of their nationality, age, or sex were included.

On the level of the hospitals involved, letters were sent to the nursing directors of the three hospitals asking them for permission to have access to the ICUs and staff working in these units.

CHAPTER FOUR: RESULTS

Introduction

One Hundred questionnaire were distributed to the intensive care staff. The researcher visited the hospitals included in the study, introduced head nurses to the questionnaire sheet and expressed the expectations concerning the time limit. Questionnaire collection took one and a half months.

Sample description

A total of 87 completed forms were returned. The response rate was 87%. The 87 participants were from three hospitals (Jazira 37, Mafrag 21, and Central 29). The majority of participants had more than five years experience (Table one). The average years of experience were 4.79 years.

TABLE ONE: Years of experience in ICU

Years of experience	Number of respondents
< 2 years	22
2-5 years	15
> 5 years	50
TOTAL	87

The majority of the participants were qualified nurses. Out of the 87 participants, 83 were qualified nurses; three

Figure one shows that the majority of nurses did not receive training on how to use CTSS.

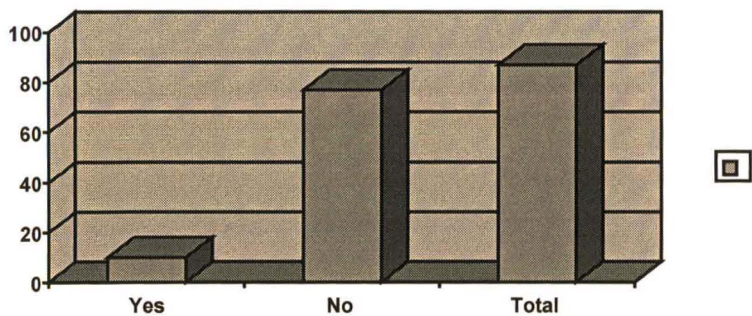


FIGURE ONE: Staff who received training on CTSS

Most participants rarely used the CTSS on ventilated patients as it appears in Table Three.

TABLE THREE: Frequency of using CTSS on ventilated patients

Frequency	Number of participants
Never	1
Rarely	64
Often	19
Most of the time	3
Always	0
Total	87

Figure Two shows that most of the participants did not follow a standard policy and procedure for the use of the system due to the absence of such guidelines in their units.

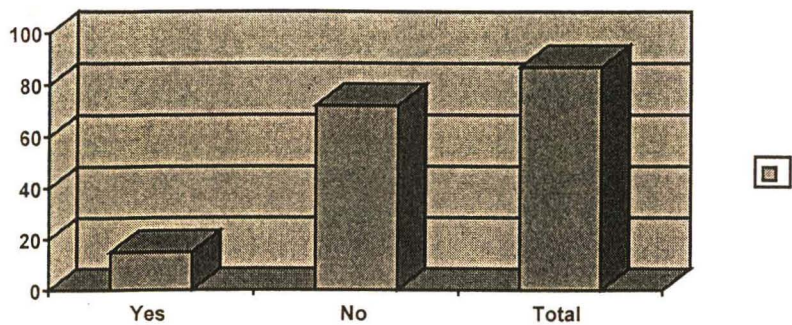


FIGURE TWO: The availability of Policy and procedure guidelines in the ICUs for performing the CTSS.

Problems experienced

The difficulties met during using the CTSS were analyzed. The findings showed that 28 of the participants experienced no difficulties when using CTSS. However, 59 participants experienced some kind of difficulty with some regularity.

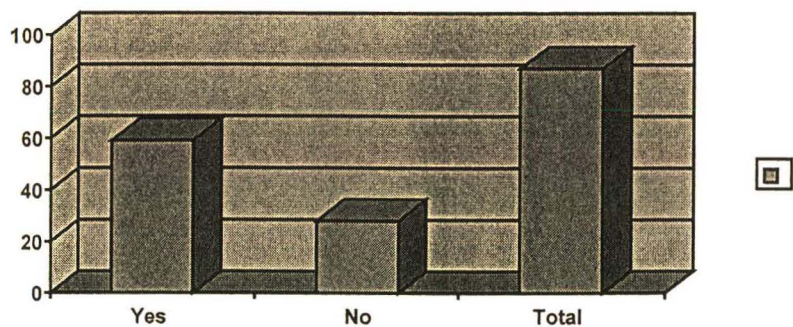


FIGURE THREE: Percentage of participants who experienced difficulties while using CTSS

The difficulties met are arranged under three main sections. These are the frequency of splashing of condensate, frequency of sticking of the suction catheter, and the effectiveness of airway clearance. The majority of the participants never had a problem in splashing of condensate, sticking of the catheter or ineffective airway clearance. The data of the difficulties met is presented in Table Four.

TABLE FOUR: Frequency of difficulties met during CTSS

Frequency	Splashing	Sticking	Clearance of air way
Never	46	59	32
Rarely	21	16	14
Often	13	8	19
Most of the time	4	3	16
Always	3	1	6
Total	87	87	87

Table four indicates that these difiiculties were never met by most of respondents.

Table Five shows the summary of the knowledge status of the respondents for the 11 items.

TABLE FIVE: Frequency of scores of the respondents

Range of scores	F	%	cumf	% of cum f
0-5	32	36.78	32	36.78
6-10	55	63.21	87	100
11	0	0	87	100
Total	87	100		

The average score for all respondents was six out of 11 (54.5%), which indicates a rather low level of knowledge.

TABLE SIX: Frequency of questions answered correctly

Question	1	2	3	4	5	6	7	8	9	10	11
Frequency of correct responses	15	9	5	51	59	77	82	77	19	63	38
%	17	10	6	59	68	89	94	89	22	72	44

Table Six shows that less than 50% of the sample knew the answers to questions one, two, three, nine, and eleven as it is recommended in evidence based literature.

Details of frequencies on the knowledge items

TABLE SEVEN: Frequency of changing CTSS catheter

Frequency	Number of participants
Every 24 hrs	80
Every 48 hrs	1
Every week	6
Total	87

TABLE EIGHT: Frequency of different actions with regard to CTSS

Frequency	Int	Oxyg	Vent	Oxyg + Vent
Never	*54	19	36	37
Rarely	15	29	26	32
Often	8	15	15	14
Most of the time	1	*10	*4	*2
Always	9	*14	*6	*2
Total	87	87	87	87

Key: Int = Interrupting CCS to use open system.

Oxyg= Hyperoxygenation

Vent= Hyperventilation

* = Correct procedure

Proven benefits

TABLE NINE: Frequency of the proven benefits of CTSS

BENEFITS	Yes	No	Total
Maintain the level of peep	82*	5	87
Decrease bacterial pneumonia	75*	12	87
Decrease in bacterial colonization	65	22	87
Decrease oxygen desaturation	71*	16	87
Decrease tracheal damage	42	45	87

* = Correct answer

The relation of the variation in knowledge among participants with other items revealed the following:

A positive correlation (+0.0433) between the level of knowledge and length of use of the system was revealed but the effect is minimal. Again the knowledge and the frequency of use on ventilated patients were minimally positive (+0.0898). On the other hand, the relation between the level of frequency of use and the years of experience was more positively related than the knowledge. This does not mean that the more experienced nurses necessarily appreciate the importance of the system. It could be purely due to the longer time they spend in contact with the system.

Conclusion

The analysis of the data revealed a variety of experiences and different duration of CTSS use. Even within the group which used the system, there was variation in the frequency. Participants expressed meeting difficulties in using the system at different levels. Knowledge deficit was evident in some aspects of the CTSS use. It was found that few nurses had official training to use this system. Respondents also did not perform the procedure according to a standard policy and procedure which leads to individual differences in the skill to perform CTSS.

CHAPTER FIVE: DISCUSSION AND CONCLUSION

Introduction

Based on the analysis of data, this chapter presents the main findings, their importance, and how they are related to each other. The results will be discussed on the basis of previous studies and research done on similar issues.

Suggestions and recommendations are pointed out as a guide for possible change and further development of staff. Further studies are recommended which relate to the subject and possibly more specific ones.

Major findings and discussion

The responses on the proven benefits showed the following facts:

Noll, Hix, & Scott (1990); Ritz, Scott, & Coyle (1986) found that CTSS is an effective way in maintaining the level of PEEP compared to OSM and thus preventing atelectasis. Ninety four percent of respondents showed an understanding of the importance of CTSS maintaining PEEP. The practice of participants (70%) reflected this understanding by maintaining the CTSS without interruption.

Clinical advantages of CTSS have been reported in literature. It has been found that CTSS decreases oxygen desaturation (Harshbarger, Hoffman, Zullo, & Pinsky 1992). This finding was reflected in the answers of 61.77% of the respondents.

The findings from the data analysis on the effect of CTSS on decreasing the bacterial contamination coincide with literature. Most of the participants (81%) agreed on the importance of CTSS in decreasing bacterial contamination. A number of authors strongly supported the findings that CTSS is more effective in preventing ventilator-associated pneumonia when compared with OSM

(Hyperlinkhttp://www.rtcornet.com/examinations/exam%20Topic/Airway/closed_suction_cal8/11/21n; Weber, 1988; Baker, 1989).

However, the responses on the decrease in bacterial colonization indicate that the majority (74.71%) think that CTSS decrease bacterial colonization. Here the results do not reflect the literature findings in this respect. Deppe, Kelly, & Thoi (1990) found that colonization was higher in CTSS.

There was no significant difference between the respondents who agreed (42%) and those who did not agree (58%) on that CTSS decreases tracheal damage. Czarnik, Stone, & Everhart (1991) found that in both OSM and the CTSS there were significant damage to tracheal tissues.

The findings on the actions of participants with regard to CTSS showed that more than half of the participants did not interrupt CTSS during the procedure. This practice is healthy to save the purpose of the closed suctioning system. The sheath allows for suctioning of the patient without exposing the

catheter and requiring the removal of the patient from the ventilator (Hyperlinkhttp://www.rtccorner.com/examinations/exam%20Topic/Airway/closed_suction_ca 18/11/21n).

Harshbarger, Hoffman, Zullo, & Pinsky (1992) recommended the use of hyperoxygenation before and after tracheobronchial suctioning in order to prevent desaturation. Stone, Vorst, Lanham, & Zahn (1989); Chulay 1988) & Goodnough (1985) supported the use of both hyperoxygenation and hyperinflation to prevent suctioning-induced hypoxemia. However, most of the participants in the study (60%) lie between rarely and never performing the procedure without using hyper-oxygenation and 72% lie between rarely and never performing it without using hyperventilation. Although there is no research which has studied the value of both hyperoxygenation and hyperventilation together, a big percentage of the responders (79%) did not practice it.

Low levels of difficulty were reported, probably due to the low rate of use. Most of the respondents experienced the sticking of the catheter, as reported in literature Blackwood, (1998).

What the majority of nurses reported in proven benefits coincides with what has been reported in literature except for the bacterial colonization. Nurses are not aware of the size of

bacterial colonization that accumulates during the use of CTSS. The participants' responses to airway clearance showed almost an equal distribution between never and rarely and the other options.

From the data presented in figure two, around 80 percent of respondents confirmed that there is no policy and procedure guidelines used in the three ICUs. This means that nurses do not have uniformity in the use of the CTSS.

Recommendations

For staff development:

Exposing nurses to more information and evidence based studies about CTSS would enhance their knowledge about the real benefits of the system and motivate them to start using it when there is a criteria for that based on the proven benefits. Agencies of the CTSS and staff development departments in the hospital should be called upon to set a training programme for the nurses involved in the use of the CTSS. This programme is expected to entail safe and skilled practice of the procedure. Critical care units should provide clear and evidence based policies and procedures for the practice of the CTSS to standardize the quality of this procedure among all those performing it.

For further research:

This study covered a group of critical care nurses with a variety of duration and background experiences in the UAE setting. Replication of the study would be beneficial in looking at how other critical care nurses in other settings perceive the issue. Although this study covered the most common concerns in using the CTSS, cost and time management issues are still worth looking at when the feasibility of the use of CTSS is considered. Moreover, the influence of the non-nursing health professional and administrative policies is another concern that could be considered in further studies.

Limitations

The limitation of this study is that the sample was chosen mainly from nurses. If the sample included other non nursing care givers, The results of the study could reflect a better and broader view of the issue.

Although most of the aspects related to the CTSS were surveyed, the cost effect issue was not covered.

Conclusion

In summary, closed tracheal suction system benefits have been reported in literature. In this study, the frequency of use did not match what has been reported in literature. Moreover, the quality of practice when the system was used did not

show enough and safe knowledge in performing the procedure. Although it was minimal, knowledge and experience had an effect on the frequency of use. From the questionnaire on the knowledge, lack of contact to evidence based information on the topic was evident. This calls for the need to set a plan aiming at making the system more frequently used not only that, but it should be used safely and appropriately based on policy and procedure supported by updated evidence based data.

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Appendix one: Cover Letter to the participants

Dear colleague,

I have embarked on a study on the use of closed tracheal suctioning system (CTSS) vs the open suctioning method (OSM) by ICU nurses. It will be done by Ahmad M. Ali as a part of the requirement of his master's degree in critical care nursing with Natal University, Durban, South Africa. The purpose of this study is to explore the experience and perception of nurses with CTSS, the difficulties they encounter in using this system, and then find ways to improve the practice of ICU nurses in this regard.

Your anonymity, privacy and confidentiality of the information will be ensured. No information given in this questionnaire will be shared by or disclosed to an unauthorized person.

I will pass by and collect the questionnaire from you on a weekly bases for the coming three weeks from the date of distribution. You can leave the completed questionnaire with the head nurse.

Returning this questionnaire to me implies your agreement to participate in the study.

I will really appreciate your participation.

Ahmad M. Ali

Appendix Two: Questionnaire

Instructions to complete the questionnaire

Please circle the most appropriate choice. Only one answer should be checked.

Demographic data

1. Hospital: 1.Mafrag 2.Jazira 3.Central
2. Sex: 1.Male 2.Female
3. Nationality: 1. Indian 2. Phillipino 3. Arab
4.Others
4. Job Title 1. Qualified nurse 2. Charge nurse
3. Head nurse

Experience and training

5. How long have you been working in ICU?
1. < 2 years
 2. 2 to 5 years
 3. >5 years
6. Have you used Closed tracheal suctioning system
1. Yes
 2. No
7. If yes, how long have you been using closed endotracheal suctioning system?
1. < 2 years
 2. 2 to 3 years
 3. 3 to 5 years
 4. >5 years

8. Did you receive any kind of training session on the use of CSS?

1. Yes

2. No

Describe your training briefly: _____

Frequency of use of CTSS

9. Does your unit have a policy and procedure for closed suctioning system?

1. Yes

2. No

10. How often do you use closed tracheal suctioning system on ventilated patients in the ICU you work in?

1. Never

2. Rarely

3. Often

4. Most of the time

5. Always

Difficulties experienced with closed suctioning system

11. Do you have problems while using closed tracheal suctioning system?

1. Yes

2. No

If Yes, please answer the next questions

12. How often do you meet difficulties during closed suctioning system?

- 1. Never
- 2. Rarely
- 3. Often
- 4. Most of the time
- 5. Always

13. Please indicate how often you have experienced the following problems:

	1.Never	2.Seldom	3.Often	4.Most of the time	5.Always
Splashing of condensate during irrigation of the catheter					
Sticking of the suctioning catheter to the endotracheal tube					
Ineffective clearance of the airway					

Knowledge of the procedure

14. How often should hyperoxygenation be used with closed suctioning system?

- 1. Never
- 2. Rarely
- 3. Often
- 4. Most of the time
- 5. Always

15. How often should one use hyperventilation with closed suctioning system?
1. Never
 2. Rarely
 3. Often
 4. Most of the time
 5. Always
16. How often should one hyperoxygenate and hyperventilate together with closed suctioning system?
1. Never
 2. Rarely
 3. Often
 4. Most of the time
 5. Always
17. When should hyperoxygenation be used?
1. Before suctioning
 2. After suctioning
 3. Before and after
18. How often should one interrupt the closed suctioning system to use open suctioning system?
1. Never
 2. Rarely
 3. Often
 4. Most of the time
 5. Always

19. How often should one change the catheter of closed suctioning system?

- 1. every 24 hrs
- 2. every 48 hours
- 3. every week

20. What are the proven benefits of CTSS?

Maintain the level of PEEP	1.YES	2.NO
Decrease the chances of bacterial pneumonia	1.YES	2.NO
Decrease in bacterial colonization	1.YES	2.NO
Decrease oxygen desaturation	1.YES	2.NO
Decrease tracheal damage	1.YES	2.NO

21.How often are CTSS sets available in your unit?

- 1. Never
- 2. Rarely
- 3. Often
- 4. Most of the time
- 5. Always

Thank you very much for your participation

Appendix Three: Tables

TABLE ONE: Years of experience in ICU

Years of experience	Number of respondents
< 2 years	
2-5 years	
> 5 years	
TOTAL	

TABLE TWO: Length of using CTSS

Number of Years	Number of participants
< 2 years	
2-3 years	
4-5 years	
> 5 years	

TABLE THREE: Frequency of using CTSS on ventilated patients

Frequency	Number of participants
Never	
Rarely	
Often	
Most of the time	
Always	

TABLE FOUR: Frequency of difficulties met during CTSS

Frequency	Splashing	Sticking	Clearance of air way
Never			
Rarely			
Often			
Most of the time			

TABLE FIVE: Frequency of scores of the respondents

Range of scores	F	%	cumf	% of cumf
0-5				
6-10				
11				
Total				

TABLE SIX: Frequency of questions answered correctly

Question	1	2	3	4	5	6	7	8	9	10	11
Frequency of correct responses											
%											

TABLE SEVEN: Frequency of changing CTSS catheter

Frequency	Number of participants
Every 24 hrs	
Every 48 hrs	
Every week	
Total	

TABLE EIGHT: Frequency of different actions with regard to CTSS

Frequency	Int	Oxyg	Vent	Oxyg + Vent
Never				
Rarely				
Often				
Most of the time				
Always				
Total				

Key: Int. = Interrupting CTSS to use open system.

Oxyg. = Hyperoxygenation

Vent. = Hyperventilation

* = Correct procedure

Proven benefits

TABLE NINE: Frequency of the proven benefits of CTSS

BENEFITS	Yes	No	Total
Maintain the level of peep			
Decrease bacterial pneumonia			
Decrease in bacterial colonization			
Decrease oxygen desaturation			
Decrease tracheal damage			

* = Correct answer